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Irrigation Management of Silage Corn

Silage corn has gained in popularity. Corn silage provides excellent fodder for all kinds of ruminants, its net energy value being equivalent to that of high quality grass silage. The aim in growing silage corn is to have a crop that provides a high net energy output combined with a high dry matter content while suitably attractive to animals.

Corn grown for silage is usually a hybrid that matures later than the one grown for grain by up to 200 chu's. The best corn silage is made when the grain is in the late dough stage, which is when the kernels are well dented. At this stage, moisture in the whole plant should be between 65 and 70 per cent. A hybrid that reaches this stage before frost is the one to grow. The hybrid that gives a high grain yield also usually gives a high silage yield.

Sometimes it is better to harvest the crop before the hard dough stage. Ensile earlier if an unfavorable growing season has delayed maturity and frost threatens.

Generally speaking, the entire plant is harvested if the corn is to be used as silage. Although such corn is usually less mature at harvest than the equivalent grain crops, corn grain varieties may be used providing they are harvested 2 to 3 weeks early. Alternatively, later maturing varieties with their rather high yields may be chosen. Although there are no major differences regarding crop husbandry, corn destined for silage is usually sown at a higher density (28,000 - 30,000 plants per acre) and receives more nitrogen (40 - 50 kg/ha) than grain corn.

Corn's tolerance to soil salinity varies between germination and maturity. At germination, corn is moderately tolerant to soil salinity levels up to 9 dS/m. Once the corn germinates and a seedling develops, its tolerance to soil salinity decreases rapidly. Throughout the vegetative stage of growth, corn's tolerance to soil salinity is very low. As the crop matures, its tolerance to soil salinity increases a little.

Corn is not only sensitive to soil salinity, but also sensitive to extended periods of flooding (greater than 24 hours) or high water tables.

Optimum growth for silage corn occurs when mean daily temperatures range between 20 - 30°C.

Crop water requirements and crop yields

Corn develops an active rooting zone of approximately 1.0 m (3.3 ft) in nonrestrictive soils. Corn grows well on a fairly wide range of soils, but does best on well drained, deep, fertile loams. On fine textured soils, such as clay loams and clays, good drainage is important. If natural drainage is poor, a tile or surface drainage system is needed. Properly fertilized sandy soils also produce good crops.

The seeding dates for this crop are generally between April 21 and May 7. Approximately 2250 corn heat units are required for the crop to reach the proper silaging stage. The growing season is between May 10 and September 15, with seasonal moisture use approaching 510 mm (20 in.) (see figure 1). Over a 30 day period, maximum water use will be about 6.0mm/day (0.24 in./day). During the seedling stage, water use will vary from 1.0-3.0 mm/day, reaching a maximum of 6.0-6.5 mm/day during the later stages.

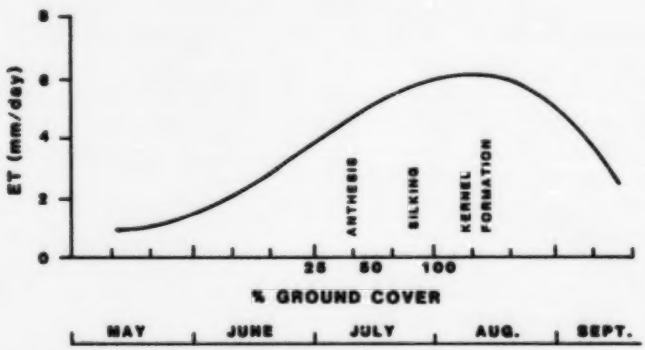

Figure 1. Crop water use of corn during the growing season.

Canopy cover is basically completed by the time crop is 1.0 m high. Its root has completed its growth by the time tasseling begins. At this time 70 per cent of the crop's water requirement is taken from the top half of the root zone (50cm).

Corn has a high water requirement but is one of the most efficient field crops in producing dry matter with the water it uses (see figure 2). It makes efficient use of applied water and it gives large responses to rather small amounts of water applied at the critical time. The critical water requirement period for silage corn is from the tasseling to soft dough filling stages. Limiting water

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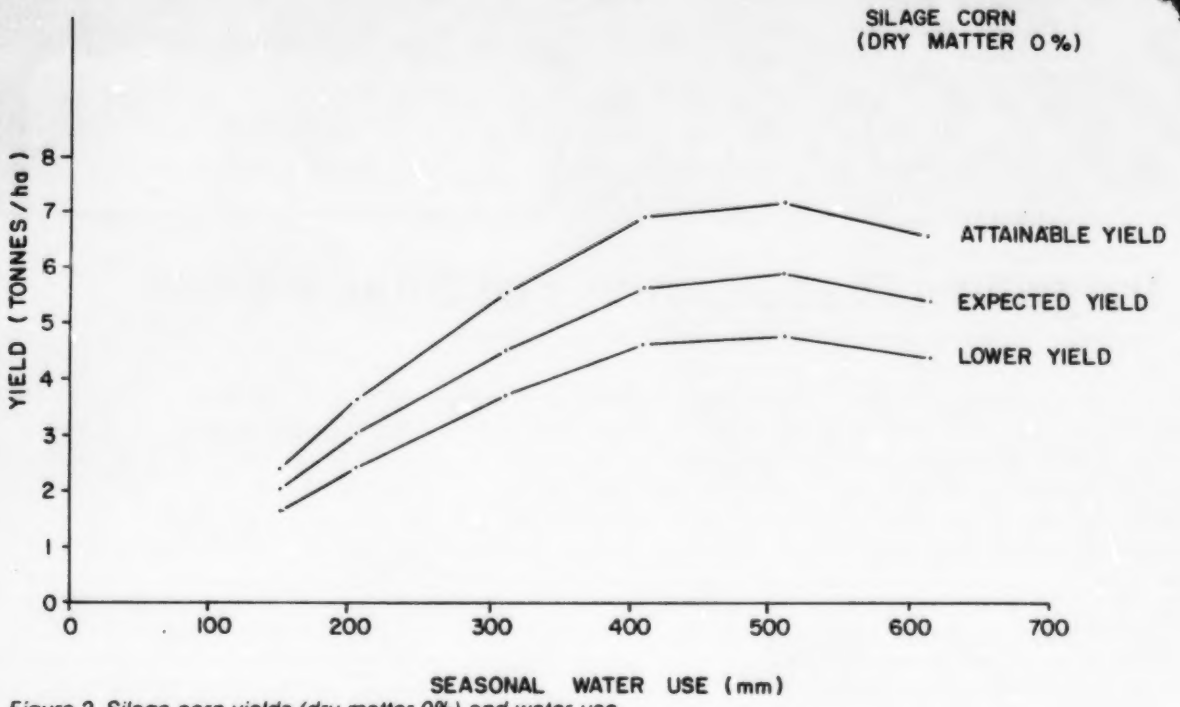


Figure 2. Silage corn yields (dry matter 0%) and water use.

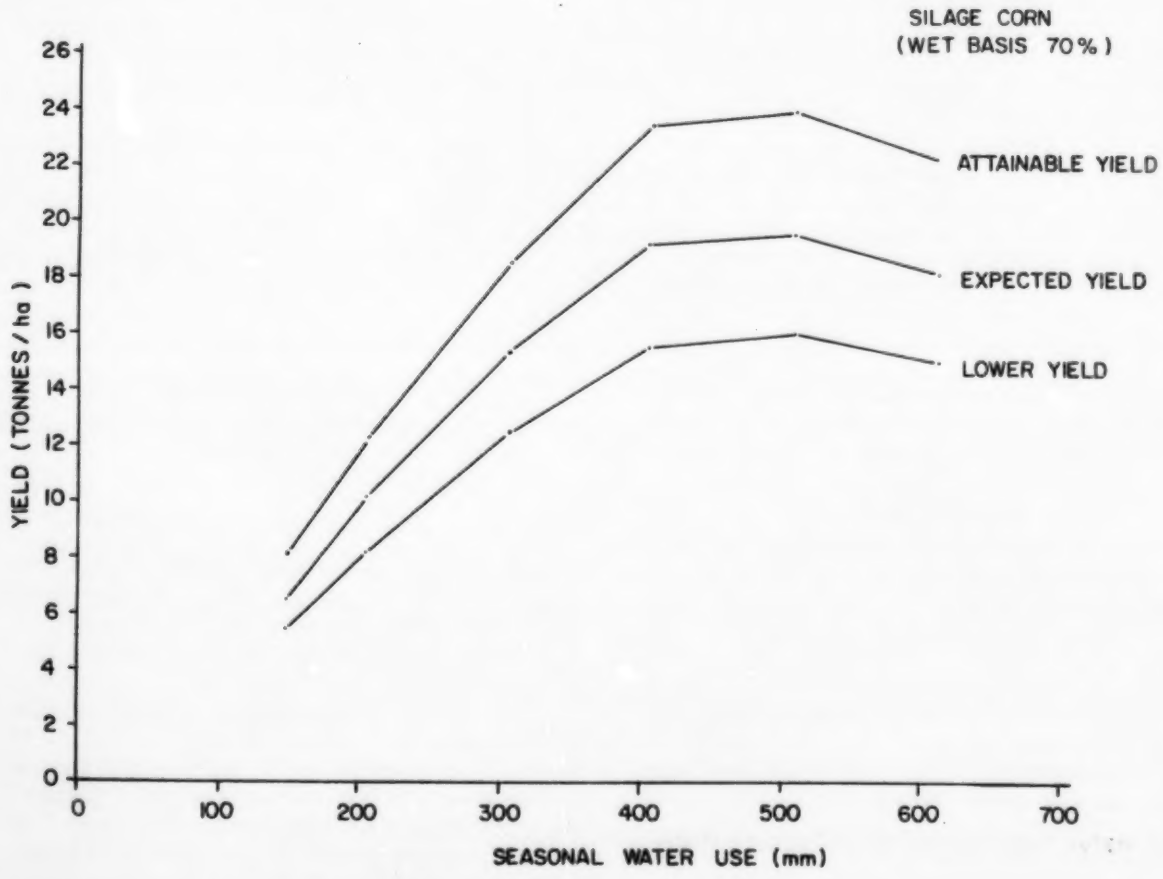


Figure 3. Silage corn yields (wet basis 70%) and water use.

during this time period will cause the greatest yield reductions in dry matter content.

Moisture stress during the vegetative stage of growth is less damaging to yield than stress after tasseling and silking. Limiting water during this time will seriously retard growth and yield.

To establish a good stand and root development adequate moisture needs to be available throughout the root zone. If soil moisture is inadequate for proper seed germination, a light application of water (25mm) should be applied. This will help to reduce the problem of nutrients leaching from the seed bed to lower depths of the root zone, soil crusting and the lowering of soil temperature.

Comments

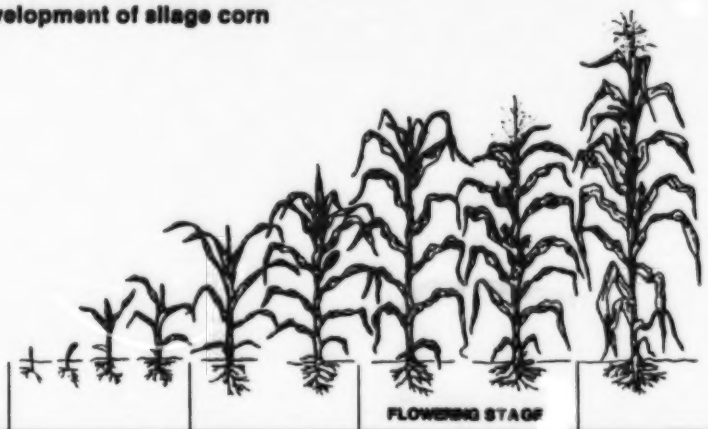
Since silage corn can only be irrigated effectively by centre pivots or surface irrigation methods, the timing and amounts of water to be applied become important. Surface irrigation methods tend to apply more water than the soil is capable of holding (with some water being lost below the root zone) and irrigations tend to be limited because of systems design or labor constraints.

Centre pivots on the other hand are able to control the timing and application of water better, but have a tendency not to be able to keep up to crop water demands. Whichever irrigation system is utilized, it is important to check soil moisture conditions after harvest to see if fall irrigation is required, and after seeding to see if sufficient moisture is available for good seed germination and seedling growth. It should be checked throughout the growing season as well to ensure adequate moisture is available for full crop development.

Irrigation management information

For further information regarding irrigation of corn, contact your nearest irrigation branch office. Location of these offices is Lethbridge, 381-5136; Vauxhall, 654-2161; Airdrie, 948-8511; Taber, 223-7908; Strathmore, 934-3356; Brooks, 362-1212; Bow Island, 545-2231; Medicine Hat, 529-3616. North of Calgary, contact the Airdrie office or your local district agriculturist for assistance.

Growth and development of silage corn



GROWTH PERIODS	ESTABLISHMENT	4 - 8 LEAF STAGE	TASSELING	SILK STAGE	RIPENING
POST EMERGENCE DATES	1400 CHU **			880 CHU	
CROP * ROOT DEPTH	2cm/DAY		2.5cm/DAY	MINIMAL ROOT EXTENSION	
MOISTURE SENSITIVE PERIOD***					
AVERAGE E.T.	1.0 - 2.0mm/DAY	2.0 - 5.0mm/DAY	5.0 - 8.0mm/DAY		< 5.0mm/DAY

Conversion factor:

tonne/ha = 0.45 tons/ac
ton/a = 2.24 tonnes/ha

* Maximum root depth will occur approximately the time flowering begins.
** CHU = corn heat unit. CHU are based on day time temperatures above 10°C and night time temperatures above 4°C. The farm rating is obtained by adding these for each day between May 25 and the first killing frost (-2°C). The hybrid rating is obtained by adding the CHU for each day between planting and physiological maturity (about 40 per cent grain moisture). The CHU available decreases by about 100 for each week planting is delayed after May 15.
*** For optimum production, the first irrigation will be required before the crop enters its water-sensitive stage.
The above depths, times and amounts are only averages for this particular crop. These values will change depending on the variety and area where this crop is grown.

Soil

Soils can vary greatly in texture from being very fine (clay) to very coarse (sand) within a crop root zone. Because soil texture can change quite quickly, so can the amount of water that the soil is able to hold.

Texture	Available Moisture
Loamy sand	8-12 mm/0.1m (0.9-1.4 in./ft)
Sand loam	10-15 mm/0.1m (1.2-1.8 in./ft)
Loam	14-18 mm/0.1m (1.7-2.1 in./ft)
Sand clay loam, clay loam, clay	15-20 mm/0.1m (1.8-2.4 in./ft)
Silty clay loam, silt loam	16-22 mm/0.1m (1.9-2.6 in./ft)

It is important to know and to be able to calculate the amount of moisture present in the soil root zone in order to understand the amount of moisture available for crop use. Allowable depletion level is the amount of soil mositure that can safely be removed from the root zone by a crop before an irrigation is required. For silage corn, the allowable depletion level has been determined to be 50%. The simplest way to determine soil moisture content is by the "feel" method. By feeling, squeezing and observing a handful of soil. The following chart outlines the various characteristics of soil based on different contents of water.

		Feel or Appearance of Soils		
	PERCENT OF AVAILABLE MOISTURE REMAINING	MODERATELY COARSE TEXTURE	MEDIUM TEXTURE	MODERATELY FINE TEXTURE
DO NOT IRRIGATE	At field capacity 100	Upon squeezing no free water appears on soil but wet outline of ball is on left hand.	Same as sandy loam.	Same as sandy loam.
	75 to field capacity	Forms a weak ball, breaks easily, will not slide.	Forms a ball and is very pliable; slicks readily if relatively high in clay.	Easily ribbons out between fingers,has a slick feeling.
IRRIGATE SPEC. CROPS	50 to 75	Tends to ball under pressure but seldom will hold together	Forms a ball; somewhat plastic; will sometimes slick slightly with pressure.	Forms a ball, will ribbon out between thumb and forefinger
IRRIGATE	25 to 50	Still appears to be dry, wil not form ball with pressure.*	Somewhat crumbly but will hold together from pressure.	Somewhat pliable, will ball under pressure.
	0 to 25	Dry, loose, single-grained, flows through fingers.	Powdery, dry, sometimes slightly crusted but easily breaks down into powdery condition.	Hard, baked, cracked; sometimes has loose crumbs on surface.

* Ball is formed by squeezing a handful of soil firmly